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Classical light simulations of quantum measurements

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Abstract content **Formatting** **Special chars**

Quantum entanglement has been at the forefront of multiple interesting studies since the release of Einstein, Podolsky and Rosen's famous paper in 1935. Its uses have extended to fields such as cryptography, teleportation and quantum imaging. The process of creating entangled bi-photon relies on a non-linear process called spontaneous parametric down conversion (SPDC). In SPDC a single photon is split into two entangled daughter photons, a process in which both energy and momentum are conserved. While SPDC has become a standard technique in generating entangled photon pairs, alignment and measurements of single photons is not a simple procedure. As such, classical light in the visible wavelength regime is used to not only align the entanglement system, but can also be used to simulate quantum measurements. This technique is known as back-projection and relies on both the conservation laws of SPDC as well as Snell's law. This technique simplifies an otherwise complex quantum system and offers a simple experimental system for predicting quantum behaviour. We illustrate this through various quantum measurements such as a Bell inequality and a full state tomography. The validity of this classical approach is highlighted in an experimental demonstration of quantum imaging.

Apply to be considered for a student award (Yes / No)?

Yes

Level for award (Hons, MSc, PhD, N/A)?

MSc

Main supervisor (name and email) and his / her institution

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No

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Yes

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